

ITEM #0507171A -HYDRODYNAMIC SEPARATOR

Description: This item includes furnishing and installing a hydrodynamic separator, a proprietary device manufactured for stormwater treatment. The hydrodynamic separator shall be a precast concrete structure and shall include an internal chamber that induces a swirling, circular, or spiraling flow pattern in the stormwater flow to separate and trap sediment and pollutants in a chamber that can be accessed for later removal.

This item shall also include furnishing and installing a flow diversion structure, manholes and pipes with the treatment capacity and to the dimensions and details shown on the plans or as directed by the Engineer. This item also includes the preparation of hydraulic design calculations for the hydrodynamic separator(s) and flow diversion structure(s) done in accordance with the Hydrodynamic Separator Guidelines as specified herein.

This item shall also include cleaning of the hydrodynamic separator of all sediment and debris every 90 days, or as directed by the Engineer, from the installation date until final acceptance of the Project.

Materials: The hydrodynamic separator shall be assembled and installed in strict compliance with the Manufacturer's instructions unless otherwise directed by the Engineer. Internal flow controls, diversion components, external appurtenances, concrete manhole riser sections, manhole frames and covers, reinforcing, threaded inserts, lifting and seating fixtures, non-shrink grout, and all other necessary materials to complete the work shall be included.

Qualified Products and Manufacturer Information: Proprietary hydrodynamic separators currently qualified by the Department are listed in **Table 1 "CTDOT LIST OF QUALIFIED HYDRODYNAMIC SEPARATORS"** based on a general review of the product's construction, function and treatment capabilities. Company contact information is provided but the Department is not responsible for its accuracy. The Engineer will reject any proposed hydrodynamic separator that is not listed in Table 1.

Performance: The stormwater treatment performance of the selected hydrodynamic separator shall be calculated by the Contractor based on Water Quality Flow (WQF) as defined in the Department's current version of the [Drainage Manual](#).

The hydrodynamic separator shall be designed by the Contractor to treat the entire WQF as indicated in the Contract, without bypass, either through the separator's internal components or at the flow diversion structure.

TABLE 1 - CTDOT LIST OF QUALIFIED HYDRODYNAMIC SEPARATORS

| HYDRODYNAMIC SEPARATOR NAME | COMPANY INFORMATION |
|-----------------------------|---|
| Barracuda | BaySaver Technologies, LLC 1030 Deer Hollow Drive Mt. Airy, MD 21771 (800)-229-7283 https://baysaver.com/ |
| Cascade | Contech Engineered Solutions 9025 Centre Point Dr. West Chester, OH 45069 (800)-338-1122 https://www.conteches.com/ |
| CDS | |
| Concentrator | AquaShield Inc. 2733 Kanasita Drive Suite 111 Chattanooga, TN 37343 (423)-870-8888 https://www.aquashieldinc.com/ |
| Xcelerator | |
| Downstream Defender | Hydro International 94 Hutchins Drive Portland, ME 04102 (207)-756-6200 https://hydro-int.com/en |
| First Defense | |
| DVS | Oldcastle Infrastructure 7000 Central Prkwy, Suite 800 Atlanta, GA 30328 (888)-965-3227 https://oldcastleinfrastructure.com/ |
| HydroStorm | Hydroworks, LLC 257 Cox St. Roselle, NJ 07203 (848)-235-5950 https://hydroworks.com/ |
| SciClone | BioClean Envr. Services 5796 Armada Dr. Suite 250 Carlsbad, CA 92008 (855)-566-3938 https://biocleanenvironmental.com/ |

Hydrodynamic separator systems and models that have been qualified for use on Department projects and their corresponding maximum allowable WQF's for stormwater treatment are shown in **Table 2, "PERFORMANCE MATRIX FOR CTDOT QUALIFIED HYDRODYNAMIC SEPARATORS."**, within the [Hydrodynamic Separator Guidelines April 2021](#)..

For more severe storm events that produce flows up to and including the Drainage Design Flow (DDF) and which result in flows greater than the WQF being directed to the hydrodynamic separator from the flow diversion structure, the hydrodynamic separator shall be designed to handle the portion of the DDF directed to it without surcharging the upstream storm drainage system and re-suspending previously trapped sediment.

The WQF to be treated and the portion of the DDF directed to the hydrodynamic separator when the drainage system is operating at its design flow are shown on the Hydrodynamic Separator

Design Data Sheets (Form A - Design attached). A separate form for each hydrodynamic separator on the Project shall be submitted by the Contractor with the Working Drawings.

Sediment Storage Capacity: Settleable solids shall accumulate in a location within the hydrodynamic separator structure that is accessible for cleaning and maintenance but not susceptible to resuspension. Manhole access in the precast concrete unit shall be provided to the sediment storage chamber and all other chambers to facilitate maintenance.

The standard sediment storage capacities for Department qualified hydrodynamic separator systems/models are shown in **Table 3, “STANDARD SEDIMENT STORAGE CAPACITY FOR CTDOT QUALIFIED HYDRODYNAMIC SEPARATORS”**, within the [Hydrodynamic Separator Guidelines April 2021](#). The capacities are based on standard structure dimensions and anticipated maintenance requirements.

The Manufacturer may increase the sediment storage capacity by increasing the depth of the standard structure. The sediment storage capacity of the proposed modified structure shall be determined by the Contractor in accordance with **Table 4, “SEDIMENT STORAGE CAPACITY CALCULATION”**, within the [Hydrodynamic Separator Guidelines April 2021](#). Revised sediment storage capacity determinations shall be clearly documented in the Working Drawing submission to the Department.

The minimum sediment storage capacities required for each hydrodynamic separator on the Project are shown on the Hydrodynamic Separator Design Data Sheets (Form A – Design attached).

Hydraulic Design: The Contractor shall prepare or have prepared a Hydraulic Grade Line (HGL) analysis for an evaluation of the selected hydrodynamic separator(s) and the design of the flow diversion structure(s). The HGL analysis shall be performed for both the WQF and the DDF. The analysis shall be consistent with the methodology described in Section 11.12 of the Department’s Drainage Manual.

Head loss coefficients, to be used in the HGL analysis, shall be determined in accordance with Section 11.12.6 for all structures except the hydrodynamic separator, which shall be obtained from the Manufacturer. Documentation shall be submitted demonstrating how the coefficient was derived either through calculation or testing data. A benching factor of 1.0 shall be applied to the flow diversion structure.

The HGL analysis (or portion of) that was performed by the Department for the design of the storm drainage systems and preparation of the construction plans, including the design of the flow diversion structure and evaluation of a “generic” hydrodynamic separator, is shown on the Hydrodynamic Separator Design Data Forms (Form A – Design attached).

Since the selected hydrodynamic separator and associated connecting pipes and structures may differ from the one assumed in the design phase of the Project, the hydraulic calculations performed for the drainage design must be replicated and revised to reflect any adjustments necessary to the drainage design for installation of the selected system (such as different flow-line elevations, head loss coefficient, pipe sizes). The selected hydrodynamic separator shall be designed so as not to change the drainage system upstream of the flow diversion structure or to increase the HGL elevation upstream of the flow diversion structure. Any modifications necessary to the overall drainage design as a result of the Contractor selected hydrodynamic separator shall be the responsibility of the Contractor.

The new HGL analysis must demonstrate the following conditions:

1. The hydrodynamic separator can treat the WQF with no bypass. The HGL elevation at the flow diversion structure for the WQF shall be below the weir elevation or elevation of flow bypass that is listed in the design data form or shown on the plans, so that all of the WQF is directed to the hydrodynamic separator for treatment. The HGL elevation in the hydrodynamic separator at the WQF shall be below the elevation of internal bypass so that all of the WQF is treated by the system.
2. When the drainage system is operating at the DDF, the hydraulic computations must show that the HGL elevation at the flow diversion structure is lower than or equal to the HGL elevation shown on Form A for the DDF and the HGL elevation in the hydrodynamic separator, and must be a minimum of one foot below the top (ground) elevation of the structure. A HGL elevation in the flow diversion structure for the DDF which is higher than the corresponding HGL elevation shown on Form A may be accepted by the Engineer only if hydraulic computations are submitted showing that the higher HGL elevation will provide a minimum of one foot of freeboard below the top (ground) elevation of the flow diversion structure and the upstream drainage structures, satisfying the design criteria in the Drainage Manual. To demonstrate compliance, the hydraulic analysis shall extend to a point upstream in the drainage system that is not influenced by the proposed changes and where the results converge with the previous design analysis. In such a case, the Contractor shall request a copy of the design analysis from the Department. A freeboard less than one foot may be accepted by the Engineer on a case by case basis provided that a justification of the reason has been included with the HGL analysis.
3. When the drainage system is operating at the DDF, the resulting HGL elevation and flow split, at the flow diversion structure, has been designed such that the portion of the DDF directed to the hydrodynamic separator does not exceed the maximum flow shown on the Hydrodynamic Separator Design Data Sheets (Form A - Design). Documentation must be provided to show that the flow in excess of the WQF can pass through the device without washout of the previously captured sediment or the device shall be equipped with an internal bypass to route the excess flow around the treatment chamber.

Upon conclusion of the HGL analysis, the Hydrodynamic Separator Design Data Sheets (Form B – Contractor Proposal attached) shall be completed by entering the HGL analysis data and other required information.

Hydrodynamic Separator Selection: The listed tables can be found in the [Hydrodynamic Separator Guidelines April 2021](#). The selection process of a proprietary hydrodynamic separator for installation on a Department project is outlined by the following steps:

1. Select the available product(s) from Table 2 (**PERFORMANCE MATRIX FOR CTDOT QUALIFIED HYDRODYNAMIC SEPARATORS**) that meets or exceeds the WQF treatment specified on the Hydrodynamic Separator Design Data Sheets (Form A - Design attached).
2. Using Table 3 (**STANDARD SEDIMENT STORAGE CAPACITY FOR CTDOT QUALIFIED HYDRODYNAMIC SEPARATORS**), check whether the initially selected product(s) in Step 1, meets or exceeds the minimum sediment storage requirement specified on the Hydrodynamic Separator Design Data Sheets (Form A - Design). In some cases, the required sediment storage capacity will govern the model size required for the Project. In lieu of selecting a larger model to accommodate the sediment storage requirement, the Contractor may submit Working Drawings showing how a standard model has been modified as recommended by the Manufacturer, to satisfy the sediment storage requirement. When a modification is proposed by increasing the depth of the standard structure, **Table 4 (SEDIMENT STORAGE CAPACITY CALCULATION)** shall be used to determine the sediment storage capacity of the proposed structure.
3. **Hydrodynamic separator system/models pre-qualified by the Department shall not be construed to mean that all products appearing on Tables 2 and 3 are suitable to any specific Site or drainage design.** The Contractor shall verify the constructability of the selected hydrodynamic separator in relation to dimensional, structural, geotechnical and right-of-way constraints at each installation Site. If revisions to the drainage design, including the system layout, are required to accommodate the selected separator, the Contractor shall provide working drawings showing the revised layout, including the position of the hydrodynamic separator and the number, positions and types of connecting structures, the design of the flow diversion structure, and any other components of the system within the pay limits shown on the plans. The Working Drawings shall be prepared in sufficient detail to perform a hydraulic analysis and confirm that the layout will fit the constraints of each Site.
4. Upon determination that the WQF, sediment storage and constructability requirements have been met, the Contractor shall prepare or have prepared, a HGL analysis in accordance with the hydraulic requirements which includes the selected hydrodynamic separator and any revisions to the drainage design needed for the installation.

5. The Hydrodynamic Separator Design Data Sheets (Form B – Contractor Proposal) shall be completed and signed by a Professional Engineer licensed by the State of Connecticut.
6. The computations must be accepted by the Engineer prior to the purchase or installation of any units.

Fabrication: Materials used to fabricate the precast concrete hydrodynamic separator including precast concrete units, brick, concrete masonry units, manhole frames and covers shall meet the requirements specified in Standard Specifications Article M.08.02, and the 28 day compressive strength shall be a minimum of 4000 psi.

The Contractor shall provide a Materials Certificate in accordance with 1.06.07 for each unit delivered to the Project. Upon request, the Contractor shall also provide Certified Test Reports for the fine and coarse aggregates and all cementitious materials, and the concrete mix design indicating the weight of each component, used in the construction of the precast units for review. The structures shall not be shipped until released by the Contractor's Quality Control Manager or designee.

The wall and slabs of the precast concrete units shall be designed to sustain HS20-44 loading requirements.

Manholes and Catch Basins shall meet the requirements of Section 5.86 of the Standard Specifications. The manhole cover of the hydrodynamic separator shall have the letters "HDS" permanently stamped or embossed on the top.

Granular fill shall meet the requirements of Article M.02.01 of the Standard Specifications.

Non-shrink grout shall meet the requirements of Article M.03.05 of the Standard Specifications.

Drainage pipe, sealant and gaskets shall meet the requirements of Article M.08.01 of the Standard Specifications.

Mortar shall meet the requirements of Article M.11.04 of the Standard Specifications.

Sealant used for the hydrodynamic separator unit(s) shall be resistant to oil and other hydrocarbons and shall meet the requirements of ASTM C443.

Construction Methods:

Working Drawings: Working Drawings in accordance with Article 1.05.02–2 shall be submitted for the system selected by the Contractor. The Working Drawings shall include the HGL analysis and all other computations in strict accordance with the "Hydraulic Design" section of this special provision, including a completed Form B – Contractor Proposal.

If revisions to the layout of the system within the payment limits as shown on the plans are required to accommodate the selected separator, the Working Drawings shall also include plans that show the required revisions. The revised position of the hydrodynamic separator unit(s), and all revisions to connecting structures, pipes, elevations, and details, including the design within the flow diversion structure shall be shown. The revised plans shall also include the pay limits showing all the components of the system that are included.

Working Drawings shall also show details for construction, reinforcing joints, internal and external components, any cast-in-place appurtenances, locations and elevations of pipe openings, access manhole locations and elevations, and the type and method of sealing pipe entrances.

Working Drawings for each hydrodynamic separator on the Project shall have all appropriate vertical dimensions referenced with elevations that are consistent with the plans. In addition to any other structural, material or installation requirements, the Working Drawings shall clearly indicate the following information:

1. The elevation and flow rate when internal flow bypass would occur within the device.
2. The location, dimensions and volume (capacity) of the sediment storage area within the device.

The Working Drawings shall be signed and sealed by a Professional Engineer licensed in the state where the devices are manufactured and that engineer shall certify the device meets the minimum requirements.

The Working Drawing submission shall consist of the following documents:

1. Working Drawings for each hydrodynamic separator proposed for installation on the Project.
2. Hydraulic design calculations including the head loss documentation and completed Hydrodynamic Separator Design Data Sheets (Form B – Contractor Proposal) with Professional Engineer signature for each hydrodynamic separator.
3. Copies of the pertinent construction plan, profile, cross section and detail sheets that have been annotated with any proposed drainage revisions required for the installation of the proposed hydrodynamic separator(s). If no changes are required, it shall be noted on the submittal.
4. An Operation and Maintenance Manual for each hydrodynamic separator describing operations, inspection, maintenance procedures and any applicable warranty information.

Acceptance of the Working Drawing submission by the Engineer must be obtained by the Contractor prior to the fabrication of each hydrodynamic separator and diversion structure.

The Contractor shall inspect the hydrodynamic separator and any accessory equipment upon delivery for general appearance, dimensions, soundness or damage in a manner acceptable to the

Engineer. If any defects or damage are identified by the inspection, the unit shall be rejected by the Contractor and a new undamaged hydrodynamic separator shall be supplied. Any required adjustments of the separator shall be completed in accordance with Manufacturer's recommendations. A Manufacturer's representative and the Engineer will inspect the hydrodynamic separator before installation.

The Contractor shall install the hydrodynamic separator structure in accordance with the Manufacturer's recommendations unless otherwise directed by the Engineer. The hydrodynamic separator shall be installed plumb, level and aligned both vertically and horizontally with the inlet and outlet piping. The hydrodynamic separator shall be placed on compacted granular fill to the depth recommended by the Manufacturer or a minimum depth of 6 inches, whichever is larger. Anchoring systems shall be installed, where needed, to resist buoyancy forces. Care shall be taken not to damage the hydrodynamic separator during backfill and compaction.

Pipe openings in the hydrodynamic separator shall be sized to accept pipes of the specified size(s) and material(s) as shown on the plans and shall be sealed. The inlet and outlet pipe connections shall be watertight. The hydrodynamic separator shall be tested for leakage according to the Manufacturer's specifications and to the satisfaction of the Engineer. Any leaks must be located and corrected to the satisfaction of the Engineer prior to acceptance of the structure.

Access openings with manhole frames and covers shall be provided to all chambers of the hydrodynamic separator. The access openings and pipe openings shall be detailed on the Working Drawings submitted by the Contractor for review and acceptance by the Engineer.

All connecting structures and pipes included within the payment limits for this work shall be constructed in accordance with the applicable requirements of Article 5.86.03 and Article 6.86.03.

Method of Measurement: Design, fabrication, furnishing, installation and cleaning of the hydrodynamic separator, flow diversion structure, manholes and pipes within the pay limits as shown on the plans, including all internal and external appurtenances and materials used, will be paid for on a lump sum basis per Site.

Basis of Payment: This work will be paid for at the Contract lump sum for "HYDRODYNAMIC SEPARATOR," complete and accepted in place, which price shall include all work within the pay limits shown on the plans for hydrodynamic separator. If revisions to the layout of the system within the payment limits for this item are required to accommodate the selected separator, the lump sum price shall also include all additional or revised connecting structures and pipes. The contract lump sum shall include the following:

1. Design, preparation, revisions of Working Drawings and hydraulic computations.
2. Concrete and reinforcing steel, sealant, cement, mortar, flexible rubber sleeves, internal and external components, brick and masonry, frames and covers used to construct access manholes.
3. Flow diversion structure, manholes and pipes as shown on the plans or as revised and shown on submitted Working Drawings accepted by the Engineer.

4. Structure excavation, backfill, and disposal of surplus material.
5. Compacted granular fill.
6. Trench excavation and bedding material.
7. Cleaning of the installed Hydrodynamic Separator, flow diversion structure, manholes and pipes of all debris every 90 days, or as directed for the duration of the Project.
8. The Operation and Maintenance Manual for each hydrodynamic separator.

The price shall include all materials, testing, equipment, tools and labor incidental thereto.

| Pay Item | Pay Unit |
|------------------------|----------|
| Hydrodynamic Separator | 1.s. |

Attachments:

1. Hydrodynamic Separator Design Data Sheets (Form A – Design), Sheets 1 & 2 of 2.
2. Hydrodynamic Separator Design Data Sheets (Form B – Contractor Proposal), Sheets 1 & 2 of 2 (blank), to be completed and submitted with the working drawings.

SAMPLE DATA

| CONNECTICUT DEPARTMENT OF TRANSPORTATION HYDRODYNAMIC SEPARATOR DESIGN DATA SHEETS (FORM A - DESIGN) | | | | | | | |
|---|---------------------|-----------------------------------|-------------------|------------------------------------|---------|-------|----------|
| Project No | Example | Route No. | 0 | Prepared By: | HD | Date: | 4/1/2010 |
| Town | Somewhere | Location/Station | Site 1 | Checked By: | DM | Date: | 4/1/2010 |
| HYDROLOGIC DATA | | | | Company: | ConnDOT | | |
| Drainage Area (Acres) | | 3.7 | | | | | |
| Percent Impervious Area % | | 53 | | | | | |
| Time of Concentration (min.) | | 11 | | | | | |
| Drainage Design Flow (cfs) | | 10.8 | | | | | |
| Drainage Design Frequency (yr) | | 10 | | | | | |
| Water Quality Flow (cfs) | | 1.7 | | | | | |
| HYDRODYNAMIC SEPARATOR (HS) | | | | | | | |
| Coordinates: | | | | Datum: | | | |
| X: | XXX,XXX | Horiz. | State Plane NAD83 | | | | |
| Y: | YYY,YYY | Vert. | NGVD-1929 | | | | |
| Head loss coefficient | | 1.75 | | | | | |
| Sediment Storage Capacity (cy): | | HGL Elevation: | | | | | |
| Required | 1.0 | @ WQF | 104.13 | | | | |
| | | @ Design Q | 104.85 | | | | |
| Maximum Flow to HS at Drainage Design Flow (cfs) | | 4.3 | | | | | |
| Comments: | | | | | | | |
| FLOW DIVERSION STRUCTURE | | | | | | | |
| Type | 4' Diameter Manhole | | | | | | |
| Weir and/or Bypass Elev. | 104.50 | | | | | | |
| Weir Length (ft.) | 4 | Weir Coeff. (C) | 3.3 | | | | |
| HGL Elevation: | | Flow Split @ Drainage Design Flow | | | | | |
| @ WQF | 104.20 | To HS | 3.2 | | | | |
| @ Design Q | 105.20 | Bypassing HS | 7.6 | | | | |
| Comments: | | | | | | | |
| | | | | | | | |
| | | | | Sketch (NTS) - Indicate Pay limits | | | |
| Sheet 1 of 2 | | | | | | | |

| CONNECTICUT DEPARTMENT OF TRANSPORTATION HYDRODYNAMIC SEPARATOR DESIGN DATA SHEETS (FORM B - CONTRACTOR PROPOSAL) | | | | | |
|--|--|------------------|--|---------------|--------|
| Project No | | Route No. | | PE Signature: | |
| Town | | Location/Station | | | |
| HYDROLOGIC DATA (Copy from FORM A - DESIGN) | | | | Name: | Date: |
| Drainage Area (Acres) | | | | License No: | State: |
| % Impervious Area | | | | Company: | |
| Time of Concentration (min.) | | | | Sketch (NTS) | |
| Drainage Design Flow (cfs) | | | | | |
| Drainage Design Frequency (yr) | | | | | |
| Water Quality Flow (cfs) | | | | | |
| HYDRODYNAMIC SEPARATOR (HS) | | | | | |
| Manufacturer | | | | | |
| Model Name | | | | | |
| Model No. | | | | | |
| Coordinates: | Datum: | | | | |
| X: | | Horiz. | | | |
| Y: | | Vert. | | | |
| Sediment Storage Capacity (cy): | HGL Elevation: | | | | |
| Required | | @ WQF | | | |
| Installed | | @ Design Q | | | |
| Head loss coefficient | | | | | |
| FLOW DIVERSION STRUCTURE | | | | | |
| Type | | | | | |
| Weir and/or Bypass Elev. | | | | | |
| Weir Length (ft.) | | Weir Coeff. (C) | | | |
| HGL Elevation: | Flow Split @ Drainage Design Flow (cfs): | | | | |
| @ WQF | | To HS | | | |
| @ Design Q | | Bypassing HS | | | |
| Comments: | | | | | |
| <i>Sheet 1 of 2</i> | | | | | |

